Apt Krzysztof

Title: Choosing Products in Social Networks

Abstract

Social networks have become a huge interdisciplinary research area with important links to sociology, economics, epidemiology, computer science, and mathematics.
We introduce a new threshold model of social networks, in which the nodes influenced by their neighbours can adopt one out of several alternatives (products).
We study various algorithmic questions concerning these networks, for example the problem of computing the minimum (resp. maximum) possible spread of a product.
Also, using game-theoretic concepts, we analyze the consequences of adopting products by the agents who form the network. In particular, we prove that determining an existence of a (pure) Nash equilibrium is NP-complete.
We explain how these results can be used to analyze consequences of the addition of new products to a social network. We show that in some cases such an addition can permanently destroy market stability.
Based on joint works with Vangelis Markakis and Sunil Simon.

Baader Franz

Title: Logic meets the real world: How can logical reasoning be used to achieve higher-level situation awareness?

Abstract

In many applications, agents (human or artificial) need to adapt to the situation at hand, for which awareness of the current situation is an important prerequisite. An important challenge in this setting is how to represent the relevant information about the current situation in a formally well-founded way, and how to integrate different pieces of such information into a coherent semantic view. To address this challenge, we propose to employ ontologies expressed in appropriate decidable, logic-based ontology languages. The question is then whether existing ontology languages such as OWL, which were designed for other purposes, are appropriate for this purpose, or whether extensions of these languages need to be designed. Is the expressive power of OWL sufficient for describing application-relevant situations, and are existing reasoning tools efficient enough to recognize situation in real time? A second important problem is how to transform (subsymbolic, numeric) sensor information into the corresponding symbolic (logical) context representation.

Bezem Marc

Title: "Elements of Mathematics" in the Digital Age

Abstract

Euclid's "Elements" have undoubtedly been the most influential, followed at a certain distance by Bourbaki. Less well known, but also potentially influential, is the "Elements"-like project Automath by N.G. de Bruijn (1918-2012). The essence of this (and more recent) projects is the ultimate formalization of mathematics, to the extent that mathematical prose (definitions, theorems, proofs) becomes machine-processable. Independent verification of proofs by a computer constitutes a transition from mathematical-proofs-as-social-constructs to full accountability. We present an overview of recent projects in computer-verified mathematics and discuss how this development can lead to a cultural change in mathematical research and education.

Bergstra Jan

Title: Perspectives in business informatics

Abstract

A precise terminology concerning insourcing and outsourcing is outlined taking care of the many differences of opinion to be found in existing work. Based on that a theory of decision taking is formulated which can be used in matters of informatics planning.

An attempt is made to formulate which long term objectives might appropriately be considered to belong to the area of business informatics, or, a phrase which I have come to prefer: business informaticology. In particular I will contemplate the question which part of business schools are likely to end up inside schools of informaticology, rather than in schools with a major emphasis on business management, economics, accounting, and marketing.

Bjøerner Dines

Title: Domain Science & Engineering: a new facet of Informatics;

Abstract
The goal of domain engineering is to construct a Domain Description. A domain description informally and formally describes - within the bounds of "what can be described" - (usually) a man-made domain such as air traffic, banking, container line shipping, hospital/health care systems, logistics, manufacturing, (gas/oil) pipeline systems, railway systems. Stock exchanges, transport, ... Such facets as technology supports, rules & regulations, scripts, management & organisation, ... are tackled.
A domain description may thus be studied (and improved upon), theorems derived etc., as are models of one or another physics domain. Domain engineering is as much an applied scientific endeavour in that - at least at the present stage - the outcome of doing a domain

description (i.e., modelling a domain) is not known a priori and that the means for modelling are not always at hand.
Domain science is then the theoretical foundation for creating models: "what can be described", "mereology", etc. The talk will survey all this and will briefly indicate that domain models can serve as a basis for requirements engineering, a conventional, usually, i.e., till now a first phase of software development. The talk will "flash" facets of models of the example domains listed earlier and will hint at philosophical issues such as mereology and a calculus of domain describers.

Bjorstad E. Peter

Title: Modeling multiscale Phenomenons with Massively Parallel Systems

Abstract

High performance computers are vital to modeling complex systems. The advance of computer technology has opened possibilities for realistic representations of truly multiscale phenomenons. Today a profound change is taking place, computers are getting faster only by way of increased parallelism. Thus, algorithms must be tailored to scale and capture multiscale behavior efficiently, when running on massively parallel hardware that exhibits linear scaling.

Pérez-Jiménez Mario de Jesús

Title: Computational Complexity Theory in Membrane Computing

Abstract

In the last decades several computing models using powerful tools from Nature have been developed (because of this, they are known as bio-inspired models). Commonly, the space-time tradeoff method is used to develop efficient solutions to computationally hard problems. According to this, implementation of such models (in biological, electronic, or any other substrate) would provide a significant advance in the practical resolution of hard problems.
Membrane computing is a young branch of natural computing initiated by Gh. Paun at the end of 1998. It is inspired by the structure and functioning of living cell, as well as from the organization of cells in tissues, organs, and other higher order structures.
The devices of this paradigm, called P systems or membrane systems, constitute models for distributed, parallel and non-deterministic computing.
In this talk, a computational complexity theory within the framework of Membrane Computing is introduced.
Polynomial complexity classes associated with different models of cell-like and tissue-like membrane systems are defined and the most relevant results obtained so far are presented. Different borderlines between efficiency and non-efficiency are shown, and many attractive characterizations of the P different NP conjecture within the framework of this bio-inspired and non-conventional computing model are studied.

Droste Manfred

Title: Quantitative Logics and Automata

Abstract

Quantitative models and quantitative analysis in Computer Science are receiving increased attention. The goal of this talk is to investigate quantitative automata and quantitative logics. Weighted automata on finite words have already been investigated in seminal work of Schützenberger (1961). They consist of classical finite automata in which the transitions carry weights. These weights may model, e.g., the cost, the consumption of resources, or the reliability or probability of the successful execution of the transitions. This concept soon developed a flourishing theory, as exemplified by the books of Eilenberg, Salomaa and Soittola, Kuich and Salomaa, Berstel and Reutenauer, Sakarovitch, and the recent "Handbook of Weighted Automata".

We investigate weighted automata and their relationship to weighted logics. For this, we present syntax and semantics of a quantitative logic; the semantics counts 'how often' a formula is true in a given word. Our main result, extending the classical result of Büchi, shows that if the weights are taken from an arbitrary semiring, then weighted automata and a syntactically defined fragment of our weighted logic are expressively equivalent. A corresponding result holds for infinite words. Moreover, this extends to quantitative automata investigated by Henzinger et al. with (non-semiring) average-type behaviors, or with discounting or limit average objectives for infinite words.

Leopold – Wildburger, Ulrike

Title: The shadow of the Past

Abstract

We study the development of cooperation in a repeated prisoner’s dilemma experiment with teams as players, unknown length and unknown continuation probability. Players are rematched with a new team twice. In such a situation - often found outside the laboratory - agents can get an idea on the likely duration of future interactions by relying on prior experience. Our main finding is that participants apparently transform the infinite-horizon game into a finite-horizon game.
Our open question is: How develops cooperation if participants are not informed about the continuation probabilities but can form expectations from prior experience? How does the shadow of the future interact with the shadow of the past?
Not only do we observe decay in cooperation but also unraveling towards the end of a matching. We found a pronounced restart effect that induces a steady rise in average cooperation over matchings. Such an effect is not observed after the unexpected continuation of the third match. Stable cooperation paths of considerable length are

induced when both players start the matching with joint cooperative moves. Our decision-based findings are corroborated by the video protocols of the team discussions.
EL Classification Number: C72, C81, C91
Key words: repeated prisoner's dilemma, unknown length, unknown continuation probability, experience, unraveling of cooperation, restart effect, mutual cooperation.

Maurer Hermann

Title: Why we need more than Wikipedia?

Abstract

Wikipedia (in particular the English, followed by the German and French versions) are large universal encyclopaedias. We claim that in addition to them it is desirable to have more region (country) specific servers that among other issues:
(a) go deeper into some aspects;
(b) address controversial topics by more than one entry;
(c) make sure that the source of each entry is known (author, archive, book,..);
(d) are dated and cannot be changed after a certain period, only comments can be added;
(e) allow to consider contributions also a long a time-line
(f) incorporate books with the feeling of books (layout, page-turning, etc.).
After a short discussion we also show a few samples from such existing regional servers.

Milutinovic Veljko

Title: A Methodology for PhD Student Advisors

Abstract

This presentation covers the following issues: Description of a 4-stage methodology and discussion of the rationales behind. The first stage implies selection of a research topic, and writing of a survey paper, which includes an original classification, uniform presentation of examples using a predefined template, and presentation of novel research ideas. Next, a methodology is presented which helps generate novel research ideas along ten different approaches to creativity. Each creativity approach is described using an example. The second stage implies a research activity based on a precisely defined methodology.
The third stage is related to FP7 activities. The fourth stage is related to start-up activities. A course that teaches all the above at the U. of Belgrade is presented in details.

Reisig Wolfgang

Title: An Integrated Theory of Informatics

Abstract

General
The century long efforts of the physics community to achieve a unifying theory as a basis for all branches of physics provides an impressive paradigm of substantial scientific progress. More recently, biology likewise started to invest much effort into research towards a reasonable notion of "theoretical biology".
In the 1980ies there were occasional attempts to establish informatics as a science of the technically supported handling of information, and as a science that would provide systematic foundational concepts for many other sciences. Those attempts eventually failed. "Theoretical computer science" referred to a narrow branch of computability and complexity. Attempts to integrate, in a formal framework, more aspects of the handling of information, never gained much support. Instead, informatics became an amazing success story with quickly evolving application layers. It became economically extremely successful also without an integrated underlying theory. Informatics thus turned into a technical application science, comparable to civil engineering.
This contribution supports the thesis that this waiver of developing a self-contained, integrated theoretical framework of informatics eventually will decisively limit the scope for the design of informatics-based systems.
The paradigm of physics
As a paradigm for an integrated theory of informatics, it is useful to study the 2500 years of development of science, in particular physics and astronomy. There we observe an amazing harmony between physics and mathematics (Mario Livio in [1] vividly describes this). One of the reasons for this phenomenon is the readiness of physicist to accept intuitively not too obvious and not at all self-evident conceptions and notions, provided they contribute structurally simple and quantifiable explanations of physical phenomena. An example is the notion of energy. This notion is fairly abstract, but it helps to relate and to quantify phenomena that otherwise could not be related and measured at all. For example, assume a stagnant car, to be driven and smashed at a wall. A certain amount of energy is involved in this process, first hidden in the gasoline, then in the acceleration, and finally in the deformation of metal sheet. In addition, the amount of energy can be quantified. Summing up, the abstract notion of "energy" is extremely useful because it provides a quantifiable invariant for dynamic processes. This kind of invariants, represented as "laws of nature", provide the backbone of science. (Further examples include Keppler's law on the movement of the planets, and equations of substance in chemical processes).
Invariants
There is a familiar notion of invariants in informatics, in particular Hoare's loop invariants [2]. Loop invariants are invariants as discussed above, indeed. However, they draw a bow over a quite narrow area, viz. over the values of the variables of a program. I suggest searching for much more general invariants. To discuss examples, such invariants may explain what remains invariant during garbage collection of an operating system, while booking a journey, soliciting money from a cash point, controlling a rocket, etc.
It may be useful to strive at a notion of "information", much richer and abstract as usually thought of so far. A fundamental invariant may be a "constant amount" of information in a system as long as the system re-arranges information in its interior, but neither receives nor

dispatches information. This, in turn may be achievable by means of atomic actions that are "reversible".
Though mere speculation so far, this way of thinking may help to better understand derived notions such as privacy, safety, security, reliability and other notions that are extremely important but so far quite difficult to grasp. This likewise applies to fundamental problems of refinement and composition of systems. Of course, all this is not to be discussed on the level of programs, but on the level of specifications.
[1] Marion Livio: Is God a Mathematician?, Simon & Schuster, NY, 2009
[2] C.A.R. Hoare: An axiomatic basis for computer programming. ACM 12, Number 10, Oct. 1969, pp.576-583

Tucker V. John

Title: Computational aspects of physical experiments

Abstract

I will introduce a theory for combining algorithms with physical experiments devised by F. Costa (Lisbon), E. Beggs (Swansea) and myself. The theory has two aims: to classify the computational power of physical technologies and to explain how algorithms control physical equipment in performing measurements. I will explain current results, based upon non-uniform complexity classes, that prove that a wide range of physical systems boost the power of algorithms beyond the Turing barrier. I will also explain how modeling a technician following an experimental procedure leads to uncertainty in classical measurements.

Tyugu Enn

Title: EMERGING THREATS IN CYBER SPACE

Abstract

Information assurance has become a fast developing subfield of informatics. However, the threats in Internet and the cyber crime are developing faster than the defense. The research in this field is mainly reactive -- the cyber threats appear first, thereafter new defense solutions are developed. Estonia fell under a cyber attack in April 2007. Thereafter, a NATO Cooperative Cyber Defense Center of Excellence was established in Estonia in 2008 with participation of ten countries today http://www.ccdcoe.org, and international master studies in cyber security began in Tallinn University of Technology http://www.ttu.ee/programmes/master-studies-2/cyber-security.
The research in cyber security includes traditional directions like cryptology, secure software development, malware etc. But it is also closely related to legal studies (development of international cyber laws), social studies (analysis of behavior of hactivists in cyber space), operations research and economy (selection of reasonable defense measures).
Looking into the future, one can predict the increasing intelligence of malware. It is highly probable that a cyber weapon of the future will be an autonomous intelligent agent with some planning ability (see “Proc. 3rd International Conference on Cyber Conflict [ICCC],” IEEEXplore, 2011.)

A scenario of development of intelligent malware in coming decades is discussed under the assumptions that computing will change from data processing to knowledge processing, and the development of intelligence of computers will follow the same path as the increase of performance of hardware. This requires a shift of attention of researchers from traditional data security and protocol security to knowledge level of cyber threats and defense.